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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re the Application of: **Akihisa INOUE** Group Art Unit: **1742**

Serial Number: **10/510,642** Examiner: **John P. Sheehan**

Filed: **April 7, 2005** Confirmation Number: **1874**

For: **SOFT MAGNETIC Co-BASED METALLIC GLASS ALLOY**

Attorney Docket Number: **042756**

Customer Number: **38834**

SUBMISSION OF AMENDED APPEAL BRIEF

Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

December 13, 2006

Sir:

In response to the Notification of Non-Compliant Appeal Brief dated December 6, 2006, Appellant submits herewith an Amended Appeal Brief in the above-identified U.S. patent application.

The previously submitted Appeal Brief was objected to because the summary of the invention section allegedly did not address the claim recitation (1) "said metallic glass alloy being cooled and solidified from its liquid phase in a super cooled liquid state" and because the summary of the invention section did not point out where the recitation (2) "minimum thickness . . . of 0.5 mm or more" is disclosed in the specification.

The previously submitted Appeal Brief explained as follows:

> In a metallic glass prepared using the alloy with the above composition through a single-roll rapid liquid cooling process in the form of a thin strip having a thickness or diameter of 0.5 mm or more, a supercooled-liquid temperature interval (or the temperature interval of a supercooled liquid region) (ΔT_x), which is expressed by the following formula: $\Delta T_x = T_x - T_g$ (wherein T_x is a crystallization temperature, and T_g is a glass transition

This paragraph has been replaced by the following amended paragraph:

> A metallic glass is prepared using the alloy with the above composition through a single-roll rapid liquid cooling process in the form of a thin strip having a thickness or diameter of 0.5 mm or more. A supercooled-liquid temperature interval (or the temperature interval of a supercooled liquid region) (ΔT_χ), which is expressed by the following formula: $\Delta T_\chi = T_\chi - T_g$ (wherein T_χ is a crystallization temperature, and T_g is a glass transition (vitrification) temperature), is 40 K or more, and a reduced glass-transition temperature (T_g / T_m) is 0.59 or more (page 2, lines 15-20). Under the cooling condition, the metallic glass alloy is solidified from its liquid phase in a super cooled liquid state. Because of its high glass forming ability, glass alloy products are obtained with minimum thickness or diameter of 0.5 mm or more (page 2, lines 15-17 and page 6, Table 1).

Thus, regarding the claim recitation (1), the following sentence has been added to the above paragraph: "Under the cooling condition, the metallic glass alloy is cooled and solidified from its liquid phase in a super cooled liquid state."

Regarding the recitation (2) "minimum thickness . . . of 0.5 mm or more," the following sentence has been added: "Because of its high glass forming ability, glass alloy products are obtained with minimum thickness or diameter of 0.5 mm or more (page 2, lines 15-17 and page 6, Table 1)." Thus, the disclosure in the specification has been specifically pointed out.

If any additional fees are due in connection with this submission, please charge our Deposit Account No. 50-2866.

Respectfully submitted,

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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

AMENDED APPEAL BRIEF FOR THE APPELLANT

Ex parte **Akihisa INOUE** (Appellant)

SOFT MAGNETIC Co-BASED METALLIC GLASS ALLOY

Serial Number: **10/510,642**

Filed: **April 7, 2005**

Appeal No.:

Group Art Unit: **1742**

Examiner: **John P. Sheehan**

Submitted by:
Sadao Kinashi
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Date: **December 13, 2006**

BRIEF ON APPEAL

(I) REAL PARTY IN INTEREST

The real party in interest is **JAPAN SCIENCE AND TECHNOLOGY AGENCY**, by an assignment recorded in the U. S. Patent and Trademark Office on **April 7, 2005** at Reel **016436**, Frame **0292**.

(II) RELATED APPEALS AND INTERFERENCES

Applicant has a similar application No. 10/506,168, Notice of Appeal of which was filed on August 4, 2006. There are no other appeals or interferences known to appellant, appellant's legal representative, or assignee that will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(III) STATUS OF CLAIMS

Claims 1 and 2 are pending. Claims 1 and 2 stand rejected and are appealed.

(IV) STATUS OF AMENDMENTS

No amendments have been filed subsequent to the close of prosecution.

(V) SUMMARY OF CLAIMED SUBJECT MATTER

The invention is directed to Co-based soft magnetic metallic glass alloys. Conventional metallic glass alloys having a relatively high coercive force are formed through a single-roll process in the form of a thin strip (or film, ribbon). For practical applications, it is desired to provide a soft magnetic metallic glass alloy capable of being formed as a bulk metallic glass with a lower coercive force. The inventor found a soft magnetic Co-B-Si-based metallic glass alloy composition which exhibits clear glass transition and wide supercooled liquid region and has higher glass forming ability. (Page 1, line 27 to page 2, line 6).

Specifically, the present invention provides a soft magnetic Co-based metallic glass alloy product with high glass forming ability, which has a supercooled-liquid temperature interval (ΔT_χ) of 40 K or more, a reduced glass-transition temperature (T_g / T_m) of 0.59 or more and a coercive force (Hc) of 2.0 A/m or less. The metallic glass alloy is represented by the following composition formula: $[Co_{1-n-(a+b)}\ Fe_n\ B_a\ Si_b]_{100-\chi}\ M_\chi$, wherein each of a, b and n represents an atomic ratio satisfying the following relations: $0.1 \leq a \leq 0.17$; $0.06 \leq b \leq 0.15$; $0.18 \leq a + b \leq 0.3$; and $0 \leq n \leq 0.08$, M representing one or more elements selected from the group consisting of Zr, Nb, Ta, Hf, Mo, Ti, V, Cr, Pd and W, and χ satisfying the following relation: 3 atomic% $\leq \chi \leq$ 10 atomic%. (Page 2, lines 7-14).

A metallic glass is prepared using the alloy with the above composition through a single-roll rapid liquid cooling process in the form of a thin strip having a thickness or diameter of 0.5 mm or more. A supercooled-liquid temperature interval (or the temperature interval of a supercooled liquid region) (ΔT_χ), which is expressed by the following formula: $\Delta T_\chi = T_\chi - T_g$

(wherein T_χ is a crystallization temperature, and T_g is a glass transition (vitrification) temperature), is 40 K or more, and a reduced glass-transition temperature (T_g / T_m) is 0.59 or more (page 2, lines 15-20). Under the cooling condition, the metallic glass alloy is solidified from its liquid phase in a super cooled liquid state. Because of its high glass forming ability, glass alloy products are obtained with minimum thickness or diameter of 0.5 mm or more (page 2, lines 15-17 and page 6, Table 1).

During the course of preparing a metallic glass using the alloy represented by the above composition formula through a copper-mold casting process, heat generation caused by significant glass transition and crystallization is observed in a thermal analysis. This proves that a metallic glass can be prepared through the copper-mold casting process. In addition, this glass alloy exhibits excellent soft magnetic characteristics, such as a low coercive force (Hc) of 2.0 A/m or less, which are significantly useful as transformers or magnetometric sensors. (Page 2, lines 21-27).

In the above alloy composition of the present invention, the metal element Fe is added in an amount of about 8 atomic% or less, preferably in the range of 2 to 6 atomic%, to effectively reduce a coercive force to 1.5 A/m or less. (Page 2, line 28 to page 3, line 2).

(VI) GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. The specification stand rejected on the ground that the specification fails to comply with the written description requirement under 35 U.S.C. §112, first paragraph.

2. Claims 1 and 2 stand rejected on the ground that these claims are anticipated by Inoue et al (US Patent No. 5,976,274) under 35 U.S.C. §102(b), or in the alternative, obvious over Inoue et al under 35 U.S.C. §103(a).

(VII) ARGUMENT

1. Claims 1 and 2 Satisfy the Description Requirement.

Claims 1 and 2 stand rejected under 35 USC §112, first paragraph, as failing to comply with the written description requirement.

The Examiner alleged that "The new claim language, 'wherein said glass alloy product has minimum thickness or diameter of 0.5 mm or more' (claim 1, the penultimate line) does not find support in the application as filed and therefore is new matter."

However, "wherein said glass alloy product as cast has minimum thickness or diameter of 0.5 mm or more" has support in the disclosure as originally filed. The specification describes as follows:

> **In a metallic glass prepared using the alloy with the above composition through a single-roll rapid liquid cooling process in the form of a thin strip (or film, ribbon) having a thickness of 0.2 mm or more**, a supercooled-liquid temperature interval (or the temperature interval of a supercooled liquid region) (ΔT_χ), which is expressed by the following formula: $\Delta T_\chi = T_\chi - T_g$ (wherein T_χ is a crystallization

> temperature, and T_g is a glass transition (vitrification) temperature), is 40 K or more, and a reduced glass-transition temperature (T_g / T_m) is 0.56 or more.

(Page 2, lines 18-23). Thus, the original description indicates that Applicant considered the thin strip having a thickness of 0.2 mm or more as his invention. Also, Applicant frequently uses in the specification the term "diameter or thickness" or "thickness or diameter" indicating that thickness and diameter are interchangeable concept (see e.g., page 2, last line, page 8, line 4).

Also, Table 1, at pages 5 and 6, shows inventive examples1-14, diameters of which are 0.5 mm or more and compares with comparative examples with diameter of 0.5 mm.

These facts clearly indicate that Applicant considered glass alloy product as cast having minimum thickness or diameter of 0.5 mm or more as within his invention.

For at least these reasons, the specification comply with the written description requirement under 35 USC §112, first paragraph.

2. The Reference Does Not Disclose Claimed Subject Matter With "Sufficient Specificity"

Claims 1 and 2 stand rejected under 35 USC §102(b) as being anticipated by or, in the alternative, under 35 USC §103(a) as being obvious over Inoue et al. (U.S. Patent No. 5,976,274).

The Examiner alleged that Inoue et al teaches an amorphous alloy having a composition that overlaps the alloy composition recited in the applicants' claims. The present claim 1 recites the composition formula as follows:

$[Co_{1-n-(a+b)}\ Fe_n\ B_a\ Si_b]_{100-\chi}\ M_\chi$,

wherein each of a, b and n represents an atomic ratio satisfying the following relations: $0.1 \leq a \leq 0.17$; $0.06 \leq b \leq 0.15$; $0.18 \leq a + b \leq 0.3$; and $0 \leq n \leq 0.08$, M represents one or more elements selected from the group consisting of Zr, Nb, Ta, Hf, Mo, Ti, V, Cr, Pd and W, and χ satisfies the following relation: 3 atomic% $\leq \chi \leq$ 10 atomic%.

A portion of Inoue et al's disclosure referred to by the Examiner reads as follows:

> The Co-based amorphous alloy of the present invention has the composition expressed by the above formula 1 and basically comprises component elements in the following five groups:
>
> Co: a base element of the soft magnetic amorphous alloy
>
> F' group: one or both of Fe and Ni
>
> M group: at least one of Zr, Nb, Ta, Hf and Mo
>
> M' group: at least one of W, Cr, Mn, Ru, Rh, Pd, Os, Ir, Pt, Al, Ga, **Si**, Ge, C and P
>
> B: boron
>
> Regarding the constituent ratios of elements in these groups, the F' group element is in the range of 0 to 20 atomic %, the M group element is 5 to 15 atomic %, the M' group element is 0 to 10 atomic %, B is in the range of 15 to 22 atomic %, and the control comprises Co.
>
> In the Co-based amorphous soft magnetic alloy of the present invention, the elements in the above groups integrally form a amorphous alloy having soft magnetism, but each of the element groups is considered attributing to the properties described below.
>
> Co: This serves as a base of the alloy and bears magnetism.
>
> F' group: This is also an element bearing magnetism. Particularly, **if 8 atomic % or more of Fe is mixed, the glass transition point Tg occurs, and thus a supercooled liquid state can easily be obtained. However, if the Fe content exceeds 20 atomic %, magnetostriction undesirably increases to 1 x 10^{-6} or more.**
>
> . . .

(Column 9, line 50 to column 10, line 11.) The following Table shows comparison of the composition of present invention and Inoue et al.

Table. Comparison Between Present Invention and Inoue et al

Present Invention		**Inoue et al.**	
$[Co_{1-n-(a+b)}\ Fe_n\ B_a\ Si_b]_{100-\chi}\ M_\chi$		$Co_{100-x-y-z-w}\ F'_x\ M_y\ M'_z\ B_w$	
Element	**at %**	**Element**	**at %**
Co	Remainder	Co	Remainder
Fe	0-8	F' (Fe, Ni)	0-20 (8-20 with glass transition)
B	9*-17	B	15-22
Si	5.4*-15	M' (Cr, W, Mn Ru, Rh, Pd, Os, Ir, Pt, Al, Ga, Si, Ge, C, P)	0-10
M (Zr, Nb, Ta, Hf, Mo, Ti, V, Pd, W)	3-10	M (Zr, Nb, Ta, Hf, Mo)	5-15

*The lower limit has been calculated on the assumption that x=10

The Manual of Patent Examining Procedure (MPEP) §2131.03 "Anticipation of Ranges" explains as follows:

> When the prior art discloses a range which touches, overlaps or is within the claimed range, but no specific examples falling within the claimed range are disclosed, a case by case determination must be made as to anticipation. In order to anticipate the claims, the claimed subject matter must be disclosed in the reference with "sufficient specificity to constitute an anticipation under the statute." What constitutes a "sufficient specificity" is fact dependent. **If the claims are directed to a narrow range, the reference teaches a broad range, and there is evidence of unexpected results within the claimed narrow range, depending on the other facts of the case, it may be reasonable to conclude that the narrow range is not disclosed with "sufficient specificity" to constitute an anticipation of the claims. The unexpected results may also render**

> **the claims unobvious.** The question of "sufficient specificity" is similar to that of "clearly envisaging" a species from a generic teaching. See MPEP § 2131.02. A 35 U.S.C. 102/ 103 combination rejection is permitted if it is unclear if the reference teaches the range with "sufficient specificity." The examiner must, in this case, provide reasons for anticipation as well as a motivational statement regarding obviousness. *Ex parte Lee*, 31 USPQ2d 1105 (Bd. Pat. App. & Inter. 1993) (expanded Board). For a discussion of the obviousness of ranges see MPEP § 2144.05.

Thus, the MPEP indicates that the claimed subject matter must be disclosed in the reference with "sufficient specificity" to constitute anticipation under the statute." The MPEP further notes that, if the claims are directed to a narrow range, the reference teaches a broad range, and there is evidence of unexpected results within the claimed narrow range, depending on the other facts of the case, it may be reasonable to conclude that the narrow range is not disclosed with "sufficient specificity" to constitute an anticipation of the claims.

Overlapping of claim 1 and the above disclosure of Inoue et al is a very small portion of Inoue et al. No specific examples falling within the claimed range are disclosed in Inoue et al. Especially, in Inoue et al, Si is just an option from a group of as many as thirteen elements. Also, Fe is selected from the group of Fe and Ni. The amount of B overlaps only at 15-17 atomic % in 15-22 % disclosed in Inoue et al. Overlapping of Fe and M are also half of the range disclosed in the range. Thus, the range portion overlapping with claim 1 in the range of $Co_{100-x-y-z-w} T_x M_y M'_z B_w$ disclosed by Inoue et al is calculated as follows:

$$1/13 \times 1/2 \times 8/20 \times 2/7 \times 4.6/10 \times 5/10 = 0.00101 = \text{about } 1/1000$$

Thus, the range portion overlapping with claim 1 is only 1/1000 of the range disclosed by Inoue et al.

Also, there is evidence of unexpected results within the claimed narrow range. The samples of examples in Inoue et al have thickness of 13 to 22 μm. Nothing in Inoue et al indicates that glass alloy product having thickness or diameter of 0.5 mm or more is obtained. Moreover, Comparative Example in Table 1 at page 6 of the present specification fall within the range of $Co_{100-x-y-z-w} T_x M_y M'_z B_w$ in Inoue et al, but metallic glass alloy product is not obtained with 0.5 mm diameter.

Moreover, the disclosure of Inoue et al referred to by the Examiner indicates that glass transition point (Tg) does not occur unless Fe is mixed 8 at% or more (column 10, line 6-9), thus, Inoue et al indicates that Fe content should be 8 to 20 atomic %. In contrast, according to claim 1, the metallic glass alloy product is obtained at 0 to 8 at% of Fe.

Moreover, the metallic glass alloy of the present invention shows low coercivity of 2.0 A/m or less. Si is contributing to the low coercivity and high glass forming ability. This is explained in the present specification at page 2, lines 3-10. Inoue et al does not teach or suggest such remarkable effect of Si.

Thus, Inoue et al discloses no specific examples falling within the claimed range to constitute anticipation under the statute. Claims 1 and 2 are directed to a narrow range and there is evidence of unexpected results within the claimed narrow range.

Therefore, claims 1 and 2 patentably distinguish over Inoue et al regardless of the disclosure of Inoue et al referred to by the Examiner.

3. CONCLUSION

For at least the foregoing reasons, the Examiner erred in finding that the specification fails to comply with the written description. Also, the Examiner erred in finding that claims 1 and 2 are anticipated by or obvious over the prior art. The Honorable Board is respectfully requested to reverse the rejection of the Examiner.

If this paper is not timely filed, Appellant hereby petition for an appropriate extension of time. The fee for any such extension may be charged to our Deposit Account No. 50-2866, along with any other additional fees that may be required with respect to this paper.

Respectfully submitted,

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(VIII) CLAIMS APPENDIX

1. (Rejected) A soft magnetic Co-based metallic glass alloy product with high glass forming ability, comprising metallic glass alloy being represented by the following composition formula:

$$[Co_{1-n-(a+b)}\ Fe_n\ B_a\ Si_b]_{100-\chi}\ M_\chi$$

, wherein each of a, b and n represents an atomic ratio satisfying the following relations: $0.1 \leq a \leq 0.17$; $0.06 \leq b \leq 0.15$; $0.18 \leq a + b \leq 0.3$; and $0 \leq n \leq 0.08$,

M represents one or more elements selected from the group consisting of Zr, Nb, Ta, Hf, Mo, Ti, V, Cr, Pd and W, and

χ satisfies the following relation: 3 atomic% $\leq \chi \leq$ 10 atomic%,

wherein said glass alloy product has minimum thickness or diameter of 0.5 mm or more, and

said metallic glass alloy has a supercooled-liquid temperature interval (ΔT_χ) of 40 K or more, a reduced glass-transition temperature (T_g / T_m) of 0.59 or more and a coercive force of 2.0 A/m or less, said metallic glass alloy being cooled and solidified from its liquid phase in a supercooled liquid state.

2. (Rejected) The soft magnetic Co-based metallic glass alloy product as defined in claim 1, which contains 3 atomic% or less of one or more elements selected from the group consisting of P, C, Ga and Ge.

(IX) EVIDENCE APPENDIX

None Presented.

(X) RELATED PROCEEDINGS APPENDIX

No decision to be submitted.